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December 1988

THE MAC FLYER - For Greater Safety in MAC Air Operations

63d MILITARY AIRLIFT WING

All about Norton AFB . . . page 16

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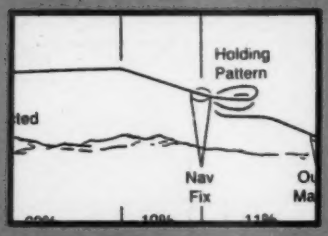

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GENERAL CASSIDY'S HOLIDAY MESSAGE

General Duane H. Cassidy

The American holiday season is unique throughout the world. Our customs and celebrations reflect all the traditions our ancestors brought from many different homelands. We are indeed a melting pot nation, and our destinies are thrown together toward the common goal of liberty, freedom and peace for all. As a nation, we are richly blessed.

We are also a nation dedicated to helping others, and the Military Airlift Command is one of the principal instruments our country uses for this. The enormous volume of humanitarian missions we flew this year, including flood relief in Bangladesh, hurricane relief to Jamaica, and famine relief to the Sudan—demonstrates that fact.

MAC people can look back at 1988 with well-earned pride. We had another busy, but successful, year and our safest flying year on record. For the first time in MAC history, we went over a year without a Class A or B flight mishap—that was only possible because each of you concentrated on doing your important work better, safer, and smarter.

The new year will soon be here, bringing new opportunities and fresh challenges for each of us. I look forward to the multitude of great things MAC will be involved in in 1989 and to serving alongside the finest people I know—the men and women of the Military Airlift Command.

Mrs. Cassidy and I wish each of you a joyous holiday and an even more prosperous New Year.

Winning Isn't Everything

Don't allow the heat of competition get the better of you . . .

By SMSgt. Tim E. Bridgeman
179 TAG, Manfield, Ohio

No one, and I do mean, no one, can spend anytime at all in the Air Force and not hear about safety. Safety is preached everyday. All aspects of any mission, both ground and flight operations, are briefed with a constant blitz for safety. Roving safety people look over your shoulder as you work. This is as it should be. In this profession you cannot stress safety enough. I have always considered safety paramount. You can never be too safety conscious. But, no matter how safety conscious a person may be, the heat of competition can blind you. Let me tell you about a personal experience.

It was a warm, sultry September afternoon. The sun was beating down on our heads as my 12-year old son, his friend and I spent the day fishing. The boys loved to fish. As we fished I spent more time looking at planes flying overhead than at my pole. The boys noticed this and started asking questions about flying. They asked all the standard questions you hear from those who don't fly. One question in particular really made me stop and think. "Is it safer on the ground or in the air?" I quoted all the old arguments about highways being more dangerous, etc., and finally the boys went back to fishing. As the sun continued to warm me, I sat back against a tree and spent a little more time thinking about this question. One incident stood out in my mind.

If you are in the airlift business, you've heard about Airlift Rodeo. How could you not hear of the biggest airlift show in the world? The competition is fierce, with a "we are the best" attitude; and if you are one of the winning teams, you can justifiably say so.

This story takes place on my second trip to Rodeo. The first year we competed, we won the Air Guard Fly-Off and the Maj. Gen. Stanley F. H. Newman Trophy.

The next year we went back with the same aircrew and, for the first time, entered an ERO (Engine Running On/Off Load) team. We felt we were as good as anyone else, but things just didn't work out the way we'd planned.

1988 MAC Flight Safety Writing Contest Honorable Mention

During Rodeo, the ERO is a timed event. Our ERO team and aircrew had practiced long and hard to come up with, we felt, a winning team. Our coordination was outstanding. Each person knew exactly what the other team members were doing at all times. We practiced hour after hour and had our combined ERO time down below the previous year's winning time. We went into the competition confident that we would win.

Scheduled to perform our ERO on the last day of competition meant a four-day layoff. On ERO day, we first had to drop a Container Delivery System bundle, land, and configure the aircraft for the ERO. The other loadmaster, flight engineer, and I knew where each chain and device was to be attached, and even how each team member expected his chains to be placed on the aircraft floor. The ERO team consisted of four aerial port people and, in our case, three crewmembers.

My job, as primary loadmaster during the upload, was to open the aircraft ramp and door when we stopped, help push two trailers into place in the aircraft, attach two chains, and close the ramp and door after deplaning the aerial port team. During the offload, I was to open the ramp and door, loosen one chain, and signal the vehicle driver and team chief when safe to drive off. During practice we had it timed so each person would complete his job at the same time.

The second loadmaster's job was to loosen his chains, and give me a thumbs up sign when everything was completed and everyone accounted for on his side of the aircraft. The ERO team chief would stand outside the aircraft to guide the truck. He would not let the truck move until I gave him the "go" sign. The team chief would stand there with his arms raised and crossed until I gave him the okay. The rest of the team would unhook their chains and jump back out of the way. When he uncrossed his arms, the driver would drive the vehicle out of the aircraft. It would take a lot of coordination.

After the four-day layoff, our upload time was not as fast as in practice, but we felt we could make it up during the download. The onboard umpire checked all the chains for security and placed himself in a position to observe the offload. During the offload, everything was running smoothly and we seemed to be making up the time we had lost on the upload. Emotions were running high. In my effort to make up time I subconsciously allowed my safety awareness to slip away. When the truck was ready to drive off, I glanced down my side of the plane and accounted for the correct number of team members. The second loadmaster gave me the thumbs up sign, and I then let the team chief know he could guide the truck and trailers off.

You can only imagine my surprise when the truck tires spun on the aircraft floor and the load failed to move. Trying to locate the problem, I looked back through the aircraft and, to my horror, saw a pair of feet protruding from between the truck and the trailer. The team member responsible for removal of those chains had encountered trouble and still had a chain attached to the floor. Had he removed the chains in a different order, I would have allowed the truck to drive over him!

The person I had seen out of the corner of my eye was the umpire! He was standing where the team member, who was having difficulty removing his chains, always stood. I gave the team chief and the driver the hold sign, let the team member complete his job, and then, only then, after very carefully insuring everyone was out of the way, completed the download. I had only myself to blame for this near-tragedy.

I was personally responsible for almost seriously hurting one of our team members. This man trusted me *NOT* to allow the truck to move until accounting for *ALL* team members! I had let him and the rest of the team down. I let the pressure of competition get the better of me and forgot about good, basic safety principles.

Thankfully, no one was hurt, and the team member eventually forgave me. When I think of that incident, I shudder. I vowed, right then, never to let events force me to lose sight of the fact that safety must always come first.

As my thoughts returned to the present, I realized I had not given the boys a good, sound answer. It doesn't make any difference if you are on the ground or in the air. Every individual must make a conscious effort to ensure his own safety and the safety of *ALL* those around him.

SMSgt. Tim R. Bridgeman's 20 years' experience include 8 years as crew chief on fighter aircraft (active duty) and 12 as a C-130B loadmaster in the Air National Guard. He is currently an instructor, evaluator, and the unit's tactics loadmaster.

Night Vision Goggles

A User's Guide

By Maj. Dave White
1275 TEF, Edwards AFB, California

The Air Force is rapidly developing and implementing new means of conducting operations at night. LANTIRN, FLIR, radar, and laser technology are contributing to our ability to strike in the dark. For MAC's Special Operations units, the PVS-5 and ANVIS-6 Night Vision Goggles (NVGs) are old news. But, do you, the user, really know what's going on inside those tubes? More importantly, do you know what their limitations are? I'll give you a hint—there are inherent limitations in your favorite set of NVGs and this article will show you what they are.

First, how do those intensifier tubes work? The second generation (PVS-5) and third generation (ANVIS-6) tubes are very similar (Figure 1). The primary difference is in the Ion Barrier film found in the ANVIS tube. Operation of the intensifier tube is very simple. Light entering the tube strikes the photocathode, which emits electrons when stimulated by light.

These electrons then enter the Microchannel Plate (MCP), as shown in Figure 2. The MCP is a wafer composed of thousands of tiny glass tubes. The interior of these tubes is coated with a reactive substance that emits electrons when struck by an electron. The MCP is canted 8 degrees to ensure that an entering electron gets maximum bounce effect as it travels through the tube.

All these multiplied electrons exit the tube and strike a phosphor screen, which gives us the visible amplified image. The image is then righted by a twisted bundle of fiber optics, giving us our upright picture. The photocathode, MCP, and phosphor screen are extremely close together which prevents spreading electrons and consequent picture blurring.

Those are the basics of intensifier tube operation. You are probably asking, "What burns out a tube? Why do tubes get poorer with age?" The answer is that the MCP generates a backscatter of ions as a by-product of electron multiplication. This backscatter strikes the photocathode, damaging it, and over time, destroying it. The ion barrier in third generation tubes prevents ions generated by the MCP from striking the photocathode and burning it out. (A gradual drop in productivity of the MCP also contributes to eventual failure.)

Both types of tubes incorporate protective circuitry to prevent a failure due to excessively high light levels. Called the Bright Source Protection (BSP), it reduces the number of electrons leaving the photocathode. An extremely bright scene or light source can dramatically dim the NVG, which will appear to cycle on and off as the BSP attempts to protect the intensifier tube.

Although the principles of operation are similar, the capabilities of second and third generation NVGs are considerably different. Figure 4 compares the PVS-5 and ANVIS-6 goggles in several areas. Figure 5 shows the range of light each goggle and the unaided eye can sense. Obviously, the ANVIS-6 has significantly better performance across the board. It does a better job of amplifying ambient light, gives better visual acuity (due to its superior resolution), and can operate at lower light levels than the PVS-5.

It also has a major advantage in that it is four times more sensitive in the near infrared spectrum (.7 to 1.0 micrometer wavelengths) than the PVS-5s. As Figure 5 shows, the night sky's predominant energy is in the near IR range. Additionally, Figure 5 displays the effect of the Minus Blue Filter on the ANVIS-6 goggles. This is a coating on the objective lens that cuts out all

light below approximately .55 micrometers (blue light). Now you know why we need blue or green lights in an NVG compatible cockpit. The ANVIS goggle simply cannot see the blue lights, or their reflections. On the other hand, if the unaided eye can see a light, the PVS-5s can see it even better.

All of the foregoing adds up to a very capable system. It gives us a vital capability in today's operations. But it's not perfect. Let's take a look now at limitations, defects, and other equipment hazards.

Visual acuity suffers when using NVGs. As Figure 1 shows, the best you can hope for is 20/40 with the ANVIS-6s. This means you can "overfly" your NVGs because you are going faster than the goggles will allow you to see. For helicopters, the answer is to slow down. For fixed wing types, pre-mission planning and preparation is the answer. The goggles can correct for −6 diopters (farsightedness) to +2 diopters (nearsightedness) by use of the diopter adjustment ring. However, many crewmembers still need to wear glasses under their NVGs. Finally, when you don your trusty NVGs and launch into the night, your depth perception changes in surprising ways. Studies have shown that depth perception improves out to 20 feet. From 20 to 500 ft, there is no change. However, beyond 500 ft, your depth perception is severely degraded due to reduced acuity.

Figure 1 also shows resolution capabilities of the goggles. However, you should be aware that, while good, your ability to see some objects is limited. For example, you will not see power lines, defensive cables, or some antennas until you hit them. The NVGs cannot resolve a thin target with non-reflective surfaces.

Viewing a brightly lit area limits your ability to see objects outside the area. For example, landing lights or spotlights give you tunnel vision because Automatic Gain Control (AGC) circuits in the NVGs average all received light to set the brightness on the phosphor screen. The AGC is also affected by windshield reflections from cockpit lights. For PVS-5s, lights of any color will influence the AGC. Blue lights will not affect ANVIS-6 AGC.

Other factors that limit your ability to see with NVGs include:

- Age and tube condition.
- Cleanliness and lense condition.
- Air moisture content.
- Visibility (haze, fog, rain, clouds, dust, smoke).
- Aircraft windscreen condition.

Tube condition depends on proper care and maintenance, including scheduled nitrogen purging, to obtain maximum life. Humidity and visibility restrictions cause halos around light sources, or a grainy or snowy picture. The condition of the windscreen you are looking through also limits NVG performance by filtering IR light, thus reducing contrast.

The goggles also contain several potential defects. This is a result of the manufacturing process used to make the fiber optic twist. Distortions in the visual scene occur as shown in Figure 6. If the bundle is over or under twisted, angular distortion occurs. If a fiber segment is dislocated, shear distortion occurs. Gross distortion due to non-uniform twist can make a flat surface appear to bulge up or to be depressed. It can similarly affect vertical surfaces. Note that all goggles have these defects to some degree. They are most noticeable at higher light levels and are normally most obvious in the center of the field of view (FOV). With one bad tube and one good tube, the effect is minimized. With two bad tubes, the effect is multiplied.

A number of other problems can occur with NVGs. These are shown in Figure 7 and include:

- Shading. A dark area at the edge of the FOV. This will eventually grow toward the center.
- Edge glow. A bright or sparkling area at the outer portion of the FOV. To check for this defect, block out all light and check the edges of the FOV.
- Bright spots. Flickering or constant bright spots caused by a pinhole in the phosphorous screen. Again, block all light entering the tube to check.
- Dark spots. Evaluate for size and location in the FOV.
- Fixed pattern noise (honeycomb). Most often seen in high light levels or when viewing very bright lights. If honeycomb remains or occurs in a dark environment, a problem exists.
- Veiling glare. Dirty, chipped, or scratched lenses can scatter light that strikes at an angle, causing glare and reducing contrast.
- Flashing, flickering, or intermittent operation. Check for lose wires or connections.

If shading, edge glow, bright spots or flickering are present, do not fly with the affected goggles. Also, if excessive dark spots, veiling glare, honeycomb, or distortion interfere with vision—leave the goggles behind.

Some of these problems may be due to defective batteries. Here, too, there are some things you should know. First, there are two types of batteries you can use: The BA-5567/U lithium battery, or the BA-1567/U mercury battery. New battery packs, in production since January 1988, will allow you to also use BA-3058/U alkaline batteries. (These are the same AA

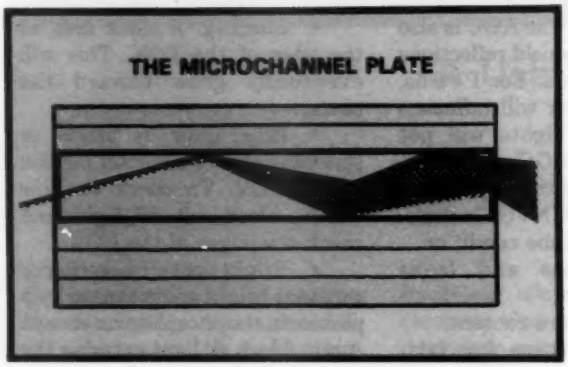


Figure 1

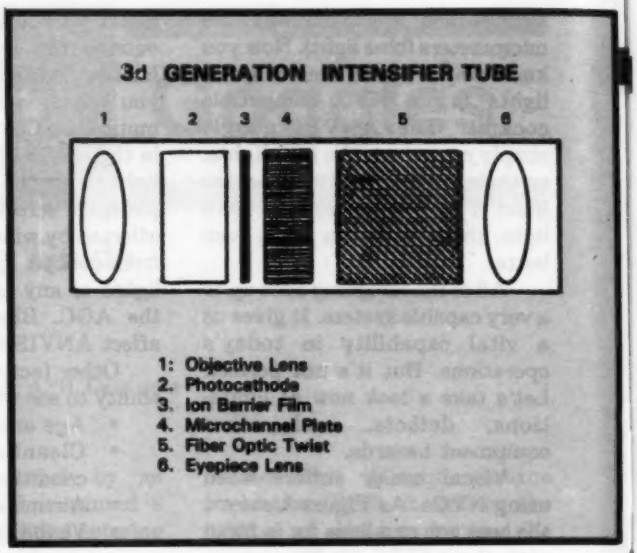


Figure 2

Battery Lifetimes

ANVIS-6 Hours of Service (Min/Max)

Temp (F)	BA1567/U Mercury	BA5567/U Lithium	BA3058/U Alkaline
100	6/12	13/16	10/22
70	6/12	13/16	10/22
-20	0	5/8	1/3

Notes: 1) Times are until low battery indicator turns on at 2.3V.
2) Data is based on maximum current draw (50 mA).

PVS-5 Hours of Service

100	24	32	50
70	24	32	50
0	3.2	24	24
-20	0	18	10

Notes: 1) Times are to end of useful battery life at about 2V.
2) Data assumes use of IR illuminator 10% of time. Longer use significantly decreases lifetime.

Figure 3

RADIANT SENSITIVITY (mA/W)

PVS-5/ANVIS-6 Comparison

Characteristic	PVS-5	ANVIS-6
Notes Light amplification	1000X	3-4000X
Best acuity	20/60	20/40
Resolution (L-P/MM)	28	36 (1)
Sensitivity (mA/Lumen)	350	1000
Lifetime (Hours)	2-4000	10,000
Magnification	1X	1X
Field of View (deg)	40	40 (2)
Focus Range	10"-Infinity	10"-Infinity
Temperature limit (C)	-54 to 52	-33 to 52
Minus Blue Filter	No	Yes
Weight (Pounds)	1.9	2.0

Notes: 1) L-P/MM is Line-Pairs per millimeter. This measures how many black and white lines (line-pairs) the goggle can resolve in a millimeter.
2) Many people report difficulty getting the full 40 degree field of view with ANVIS-6 NVGs.

Figure 4

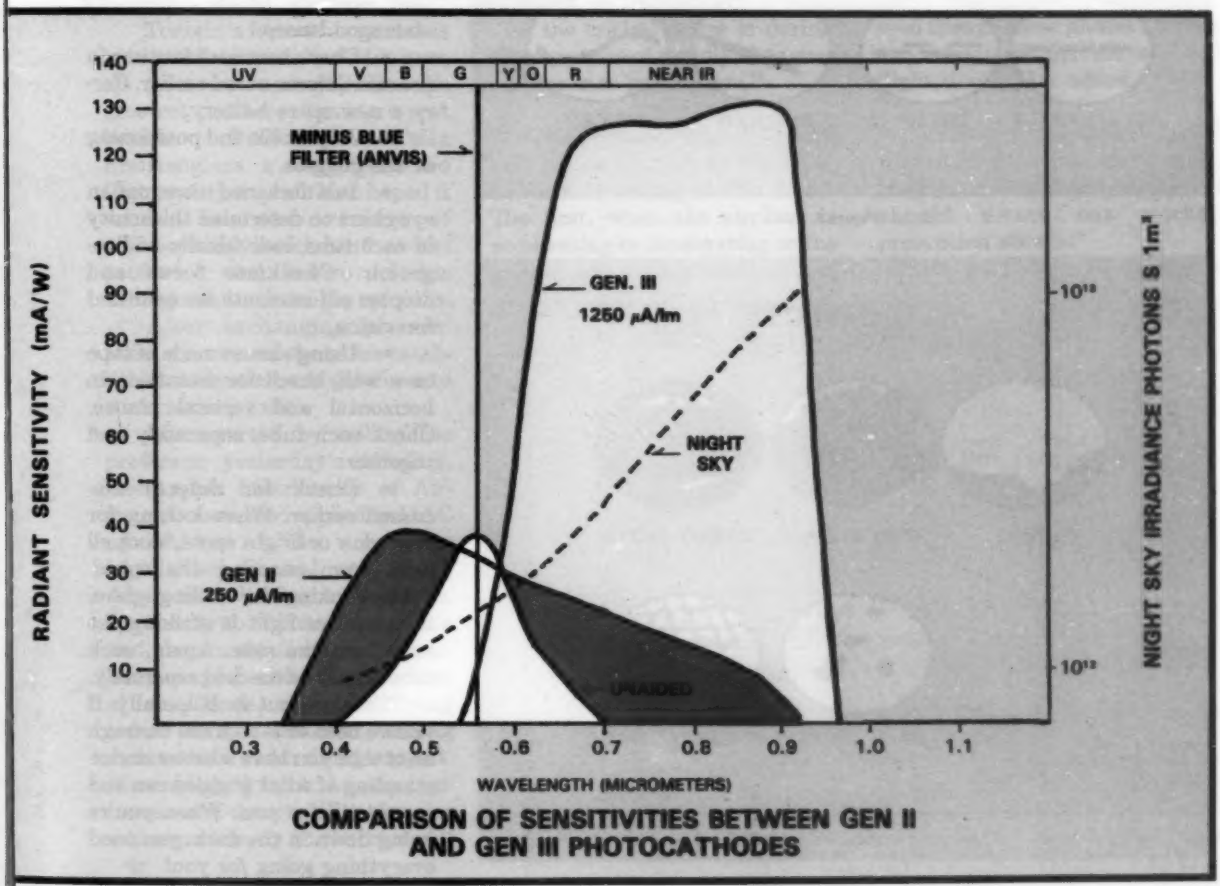


Figure 5

batteries you use in a penlight.) See Figure 3 for a comparison of expected battery lifetimes. You should be aware that lithium and mercury batteries maintain original voltage to the end, while the AA batteries slowly lose power with use. Some battery safety tips:

- Inspect them before sticking them in your goggles. Don't use them if they're damaged or swollen. You can check for swelling by twisting the plastic case, which should turn freely.
- Turn off the goggles before inserting or removing batteries.
- Don't carry them unwrapped in your pockets with metalic objects.
- Periodically check the battery case for excessive heat. If you have an overheated battery, don't use the NVGs.
- If you have a lithium battery fire, *do not* use a Halon fire extiguisher on it. Burning lithium and Halon generate toxic vapors.
- Record the time the battery has been used. Units need to establish procedures to keep track of time on their batteries. It's guaranteed that your battery of unknown age will shut down when you need it most. Remember Murphy? Carry a spare!
- Don't leave batteries in equipment that isn't being used. The battery can leak and cause corrosion.
- Finally, don't throw batteries in local garbage. Contact your local DPDO to establish procedures for spent battery disposal.

Well, now you know what to look out for in your goggles. The answer to all of these problems is a good preflight. Merely focusing on a star will not detect most of these deficiencies. As a minimum, I recommend you do the following:

- Thoroughly clean objective and eyepiece lenses. Check for damaged lenses.
- Check batteries for time in use and defects noted earlier. Carry a new spare battery.
- Adjust tilt and positioning of the goggles.
- In a darkened room, use an eye chart to determine the acuity of each tube, individually and together. Check/set focus and diopter adjustments for near and far vision.
- Using a cross made of tape on a wall, check for distortion in horizontal and vertical planes. Check each tube, separately and together.
- Check for defects discussed earlier. When looking for edge glow or bright spots, block all light from entering the tubes. When looking for veiling glare, turn so that light is striking the lens from the side. Again, each tube should be checked separately.

That's about it. Hopefully, if you've been able to wade through all of this, you have a better understanding of what goggles can and cannot do for you. When you're going down in the dark, you need everything going *for* you!

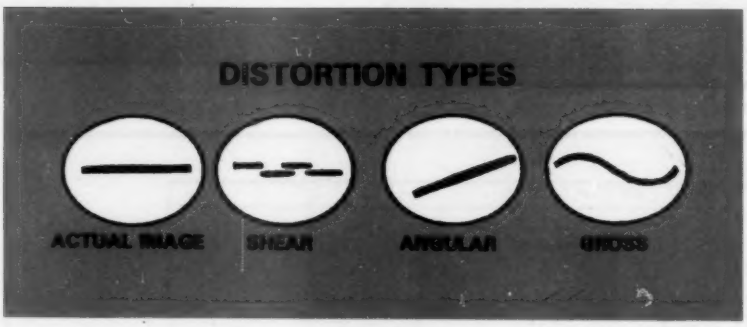


Figure 6

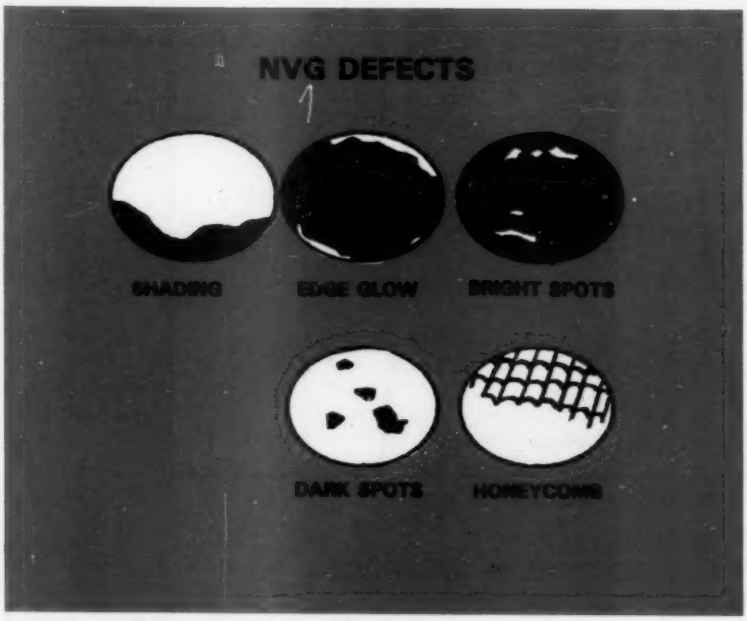


Figure 7

Shared Experiences

It was a prestigious event. Capt. Brad "Mac" MacKenzie was attending, by invitation, a symposium hosted by the International Society for Safe Operation of Aerospace Machinery. The event was held in an exclusive, posh hotel in a major metropolitan city. The last two days were spent in seminars with airline industry and aerospace manufacturers presenting both dismal and effective safety records.

Tonight's formal banquet was to be the final event, and Mac wore his mess dress proudly. But his greatest thrill was having a seat beside Professor Felix Frankenglass, a world-renowned flight safety expert. Mac hoped it would be an evening of philosophical enrichment as the professor was known for his willingness to share his opinions.

After exchanging pleasantries, the two safety gurus established credentials and got down to some serious talk.

Mac started by telling the professor yesterday's briefing, Geographic Distribution of Airframe Losses, also applied to MAC operations. The briefing highlighted Central and South America as leading in numbers, due mostly to deficient navigation and communications infrastructures, coupled with a large number of small-scale operators flying older aircraft without strong maintenance and training support. Mac added, "I think the very high terrain and density altitudes also add significantly to the hazard."

The professor countered, "But, terrain and density altitude problems are also present at many other locations also. In fact, they constitute a category of their own. However, let's not detract from the challenges of a 13,000 – ft airport!"

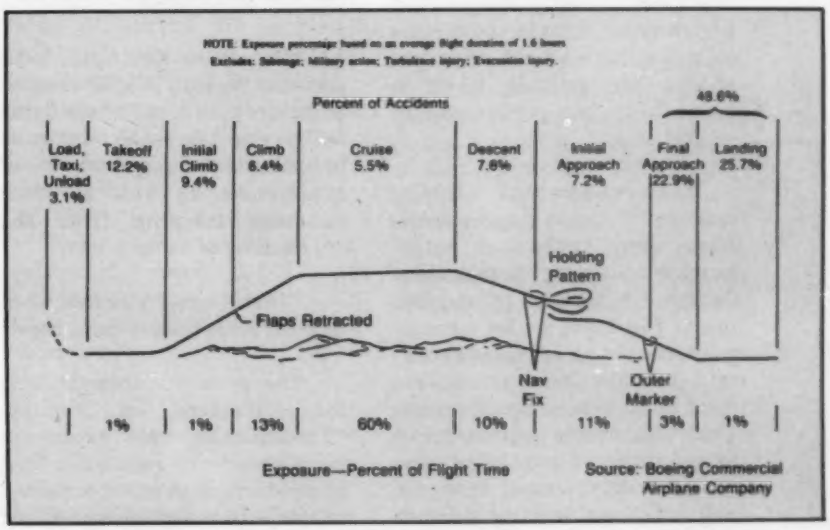
"Another seminar I thoroughly enjoyed was the one defining the most critical phases of aircraft operation" Mac said. "Of particular interest was their chart. It leaves no doubt in one's mind that the critical phase is during those periods of rapidly changing performance parameters."

The professor added, "Don't miss the leading factors I found to be most revealing in this chart. The first, when the airplane is accelerating or decelerating on the ground and during climbout and descent, can be called a mechanical factor. The other, when the craft must be physically positioned in a most precise manner, is most definitely a human factor. Their examples, instrument approaches and times when pilot workload is high and engine stresses are at their peak, lead to an obvious conclusion."

"It's not at all surprising to find nearly 80 percent of all mishaps occur during takeoff, climb, final approach, and landing, even though these phases average only about 30 percent of total flight time," Mac added.

"You're right, Mac. I deal with a lot of charts and graphs, but this one really tells a story and should direct our mishap prevention efforts."

He went on, "A mishap is



Distribution of Accidents—Phase of Flight, Worldwide Commercial Jet Fleet 1959-1986

seldom attributed to any single cause, but rather to several interrelated factors in a chain of events. Nevertheless, human error is the major factor in nearly 80 percent of all mishaps. Take for example the tragic Detroit accident. Yes, there was a failure of a warning system; however, this warning system acts as a reminder to the aircrew they hadn't completed their checklist. One might scoff at the idea that any warning system that reminds crews to do their job is extravagant redundancy—but, this case was compounded because the crew hadn't! I define this mishap's chain of events like this: the warning system was inoperative, the chain was initiated. The crew missed the checklist; as advertised, the plane could take off, yet not fly without flaps. The plane crashed, and people died. Elementary logic.

"It's easy to predict the final steps to the so-called chain of events that lead to tragedy; those are initiators we safety professionals must get our arms around. And in this endeavor, we've achieved major milestones, one of which should have been, and quite honestly was, a long known axiom. That is, the manner in which humans are managed affects their attitude, which in turn affects their performance of critical tasks."

Mac understood clearly, adding, "I couldn't agree more. How many times has better judgment given way to misguided desires for mission accomplishment? The tone, set by management, can stress 'full speed ahead,' or it can link 'safe' accomplishment to 'mission' accomplishment. This subject often becomes mired in a question of crew experience.

"A highly trained crew can pull off a particularly difficult mission without once jeopardizing safety. Yet the opposite can occur when they blind their better judgment, seeing only mission accomplishment as a primary goal. We're working this issue constantly."

"And you must!" The professor waved his finger to the ceiling. "We have recommended to airline management that they should minimize distractions for whatever reason, especially during performance of critical, rapidly varying tasks. In fact, and in support of your thesis, Mac, the three most important factors preventing human error in the cockpit are crew *training, discipline* and *professionalism.*

"I know the Air Force places those qualities atop their priority list; yet you'll admit you haven't yet found any method to ensure they exist."

Mac certainly agreed with that. "We've spent millions developing some of the best training systems in the world, yet some accidents still identify glitches in our aircrew training programs. As for discipline and professionalism, I believe you're right on the mark when you identify management."

"Of course I'm right!" the professor smiled. "A well-seasoned or mature pilot is one whose flying skills are tempered by good judgment resulting from broad experience, as well as from constant learning from the experiences of other pilots."

"That's nice," Mac said, "but how do we get there from here?'

The professor thought only for a moment, and replied, "Traditionally, this experience came about as a result of a long apprenticeship as a first or second officer with a highly experienced captain. This apprenticeship, or practical experience, is supplemented by intensive training programs, and reading and studying safety literature. I might add that your command's periodical, *The MAC Flyer,* is an exceptional source of information in this regard. Most important, however, is the social contact known as 'hangar flying.' And it's by far one of the best experience exchanges. It's not only cheap, but these contacts tend to be delightful encounters. A century before the jet age, Ralph Waldo Emerson praised this safety education method when he wrote, 'Learn from the mistakes of others because you won't live long enough to make them all yourself.' "

Mac chuckled and said, "I'll have to write that one down." Then he added, "We've known about the great benefits derived from hangar flying all along, but somehow we've gotten away from it. It's unfortunate, and we're really trying to revive it."

"Another task for management," nodded the professor. "The significant causal factor in a number of serious accidents has been inadequate crew management on the flight deck. This fact led to a number of airlines adopting variants of NASA Ames Research Center's Line-Oriented Flight Training program. I've had the opportunity to visit one of your command's variants, Cockpit Resource Management, they called it. Very effective indeed."

"Professor, if we can get a handle on human factors," Mac asked, "what do you think would be the next most common factor we could attempt to solve?"

Professor Frankenglass smiled, "Well Mac, everybody's talking about it, but nobody's doing anything about it."

Mac twisted his face in

curiosity, "I don't understand, sir."

"The weather, my lad!" The professor smiled. "Weather has always been a major foe of safe aircraft operation, but not like it used to be.

"The major focus of civil and military research, here and abroad, for the last thirty years has centered on problems caused by in-flight icing, wet runways, restricted visibility landing, clear air turbulence, thunderstorm and lightning hazards, wind shear, wake vortices, gust loading of structures, and fog. These environmental hazards are much better understood than before; satellite weather observation, advance radar capability, pilot training, and so forth have made these 'flight stoppers' nowhere near the hidden threat they were before—or shall I phrase it—they shouldn't be!

"But, as you well know, pilots are still stretching the best advice and insisting upon flight attempts that purposefully defy Mother Nature. Every winter's first snow reeducates us about its effects on aerodynamics, with one or more major aircraft accidents occurring as a result."

Changing the subject somewhat, Mac asked Professor Frankenglass what methods he saw on the horizon to test, or measure, the effectiveness of a safety program.

The professor responded, "There is no way to quantitatively define a state of safety that exists within an operation. Unfortunately, accidents are the only visible and countable final reckoning to score a safety program, but simply monitoring mishap occurrences does nothing to prevent their occurrence in the first place. It is more constructive and proactive to monitor incidents and near-mishaps. Careful analysis of incidents by knowledgeable and experienced people can provide qualitative indicators to the state of safety, and permit corrective or preventive actions to be initiated with confidence.

"Safety is affected by the resources available to detect and correct discrepancies. It is also affected by the aircrew's attitude towards their jobs. Unfortunately, it's not possible to describe with any certainty just where the line dividing tolerance for job shortcomings from hazardous job attitudes lies.

"Intuitively, we know it exists, and different management styles address this question differently. A worker's perception of his or her own economic well-being, coupled with perceptions of whether there is adequate equipment to do the job 'well,' will affect the quality of work. Indeed, the paramount necessity for mishap prevention through monitoring of incidents and modification of procedures as appropriate remains a cornerstone of safe operation.

Mac added, "In the Air Force, we've devoted a tremendous amount of effort and resources toward equipment. Unfortunately, we're somewhat limited in what we can provide toward the myriad of 'opinions' that define 'economic well-being.'"

"Very much a problem," the professor responded. "But it's not at all unique to the military, and today I'm more concerned about the future."

"How so?" Mac asked.

"Well, today's airline passenger is as safe as traveling by train, and markedly safer than traveling in cars, trucks, or motorcycles. The risk of death due to an accident while flying on a western world scheduled flight is no more than the risk of death for the average person of 44 not flying.

"This remarkable record was built on a foundation of investment in safety research and safety improvement programs begun in the late 1930s by government and industry. The results of these efforts enabled the regulated industry to implement safety features and practices that exceeded federally-required minimums, and thus build into the system a substantial safety margin. Industry and government developed an ability to respond quickly to safety problems that inevitably appear with fast-paced technological improvements.

"As a result, safety has continued to improve 'statistically,' despite the negative shocks from great increases in air traffic at a time when ATC is recovering from loss of seasoned controllers, and from an infrastructure that has remained firmly static. By infrastructure I mean airports, communications, traffic control, weather services, airway aids, and maintenance. I believe this is due in part to technological advances in new aircraft and from residual experience in older operational flight crews and maintenance personnel. The statistical record is history, and one needs to be reminded that it is indeed possible to skate successfully on thin ice, but it is much more desirable to skate on thick ice."

At this point, the dinner program began, and both men directed their attention to it. Several minutes later, the professor leaned over and whispered to Mac, "Remember this: Clear and accurate communication is essential to maintaining our present excellent level of safety." ✈

Adapted from: Aviation Safety—The Global Conditions and Prospects by Jerome F. Lederer and John H. Enders, June, 1987. Flight Safety Foundation, Inc.

Flying-Hour Milestones

15,000

41 MAS
CMSgt. John E. White, Jr.

10,000

7 MAS
MSgt. Charles W. Thomas, III.

9 MAS
Lt. Col. Charles W. Miller
Lt. Col. David Miller
CMSgt. Paul E. Roy, Jr.

185 TAS
Lt. Col. George L. Soupene

7,500

23 AF
CMSgt. Marion E. Moretz

53 MAS
CMSgt. Lawson Elkins
MSgt. Myron Dubose

75 MAS
Lt. Col. Ronald E. Burks
Lt. Col. Robert G. Podzimek
Lt. Col. John F. Takeuchi
SMSgt. Robert J. Cosgrove
SMSgt. Edward C. Ewert

7 MAS
SMSgt. Curtis S. Ocenasek
MSgt. Richard W. Perry
SSgt. Arthur L. Campbell

316 TAG
CMSgt. David F. Newell

314 TAW
SMSgt. David J. Lott
SMSgt. Michael T. Parkes

97 MAS
Lt. Col. Edward M. Duchnowski
SMSgt. Rusby S. Sides
MSgt. Michael T. Golden
MSgt. Bernard D. Kuehn
MSgt. Jarvis L. Owens

1 MAS
Col. Robert E. Ruddick
Lt. Col. Franklin A. Forsbert
Lt. Col. Jeffrey C. Paul
Lt. Col. Thomas Smith
CMSgt. John L. Haigh
CMSgt. John E. Pinkerton, Jr.
CMSgt. Roland T. Shaw
SMSgt. Joseph P. Fuller
SMSgt. Michael D. Lynn
SMSgt. John D. Timko

5,000

185 TAS
Col. Jerry W. Whitman
Maj. Roy W. Speakes

Det 1, 1403 MAS
Maj. Will H. Drow
Maj. Joseph J. McBride, III.

7 MAS
Lt. Col. Larry C. Lester

345 TAS
Maj. Joseph J. McBride, III.
TSgt. Robert Dever

75 MAS
MSgt. Ronald W. Sharp
TSgt. Joseph B. Phillips
SSgt. Gregory L. May

53 MAS
TSgt. Robin C. Hood
TSgt. Wilfred Jones
TSgt. Paul J. Mercadante

HQ MAC/DO
Lt. Col. Ira D. McCauley
Maj. Ray M. Watkins
CMSgt. Frank I. Clubb
SMSgt. Scott A. Ellestad

97 MAS
Maj. Robert F. Poland
Maj. David A. Richards
Maj. Lowell E. Scott
Maj. Raymond E. Wallace
Capt. Michael C. Hadley

2,500

23 AF
Col. Roland J. Page
Lt. Col. Thomas J. Blystad
Maj. Page A. Wagner, III.
Capt. William W. LeRoy
Capt. Scott B. Sines
Capt. Stephen P. Childers

57 AES
SMSgt. William L. Parker
TSgt. Nellie Arnold
TSgt. Michael Bonham
TSgt. Katherine Brehm
TSgt. Michael Korn
SSgt. Butch Blake
SSgt. Patrick Brandell
SSgt. Jeffrey L. Halo
SSgt. Patrick Judge
SSgt. Christopher Magnuson
SSgt. Anthony Parr
SSgt. Roland Thompson
Sgt. Daniel Faulkner

375 CAMS
TSgt. Terry E. Brehm
SSgt. Floyd A. Mohler
Sgt. Wesley D. Kern
Sgt. Thomas M. Ronchetto
Sgt. Walter Schmidt
Sgt. Aubrey E. Scroggins

1467 FCS
Lt. Col. Michael J. Ball
Maj. Mark Muehl
Maj. Charles W. Neal, Jr.
Maj. Marty J. Pruden
Maj. George J. Reioux
Maj. Michael R. Siebert
SMSgt. Stephen D. Kennedy
MSgt. Larry E. Kiracofe

Det 1, 1467 FCS
Maj. Joel R. Caudle
Capt. Gregory S. Watts

1375 FTS
Lt. Col. Richard E. Rossetti
Maj. Roger C. Muirhead
Capt. John R. Bertelsen
Capt. James L. Cashes
Capt. Ronald J. Hussey
Capt. George E. Johnson
Capt. Patrick D. Smellie
Capt. Scott W. F. Smith
Capt. Thomas V. Tornillo
Capt. Mark E. Willis
Capt. Richard L. Tierney
Capt. Hal B. Yarbrough

HQ MAC
Lt. Col. Margaret A. Seibold

375 AAW
Col. Vivian C. Pohlman
Maj. Biagio E. Cannistraci
Maj. William A. Ulm
SMSgt. Sylvester Lumpkin
MSgt. Roger D. Bennet
MSgt. Philip W. Elmore
MSgt. William H. Lloyd
MSgt. Robert J. Williams
TSgt. Gary L. Jenkins
TSgt. John B. Yacalavitch

443 MAW
TSgt. Ronald A. Leonard

1400 MAS
Lt. Col. Lester H. Ideker, Jr.
Lt. Col. William E. Thompson
Lt. Col. Ronald C. Vest
Maj. Barry B. Besold
Capt. Christopher Davis
Capt. Michael A. Heaberlin
Capt. John C. Porter
Capt. Anthony L. Steele
Capt. Robin S. Weiland

Det 1, 1400 MAS
Lt. Col. Arthur H. Lucas, Jr.
Lt. Col. John Mychalishyn
Capt. Darrel W. Manning
Capt. Donald T. Rodrigues, Jr.
Capt. Clifford White

Det 2, 1400 MAS
Lt. Col. Richard A. Mentemeyer
Lt. Col. Wayne B. Petersen
Lt. Col. Earl W. Riley

Det 5, 1400 MAS
Maj. William M. Delaney
Maj. David E. Walker
Capt. Deborah L. Davenport
Capt. Donald T. Magners

1401 MAS
Lt. Col. Victor D. Jaroch
Lt. Col. Timothy E. Shafer
Lt. Col. Thomas J. Stephenson
Maj. Stephen E. Behr
Maj. Donald R. Jozayt
Maj. Daniel P. Lefler, Jr.
Capt. Steve A. Henson

Det 1, 1401 MAS
Lt. Col. David A. Ellis
Lt. Col. Anthony B. Gentile
Lt. Col. John J. Orler
Capt. William G. Ogilvie
2d Lt. Michael A. Barrett

Det 3, 1401 MAS
Lt. Col. Jay R. White
Capt. Jeffrey S. Barath
Capt. James B. Cole

Det 4, 1401 MAS
Lt. Col. Johnny B. Drury
Lt. Col. Willard R. Haines, Jr.
Lt. Col. Glenn R. Leimbach

1402 MAS
Lt. Col. James B. Engle
Lt. Col. John L. Fox
Lt. Col. Ronald N. Priddy
Maj. Larry D. Hancock
Maj. LeRoy J. Hult
Maj. Paul D. Thor
Capt. John D. Honess
Capt. Thomas W. Hunter
Capt. David T. Kelly
Capt. Teresa A. Vandendolder
Capt. James A. Vogt
Capt. Annette . Worthington

Det 4, 1402 MAS
Lt. Col. Howard J. Colson
Lt. Col. Tillman E. Dickson, Jr.
Lt. Col. John P. Prible

1403 MAS
Maj. Glen B. Alexander
Maj. Gaylord K. Carlton
Maj. Alfred L. Crawley
Maj. Richard G. Holloman
Maj. Stephan G. Kerstock
Capt. Terry D. Stice

Det 3, 1403 MAS
Maj. Sterling K. Palmer/CC
Capt. Stephen R. Ward

185 TAS
Maj. Jerry W. Byrum
SMSgt. Odis L. Porter
MSgt. Fredrick L. Schmitt

53 MAS
Col. Gordon K. Lochridge
Lt. Col. Arthur S. Irwin, Jr.

63 MAW
Col. Edward J. Sheeran

34 TATG/CC
Col. William L. Wacker

62 TAS/CC
Lt. Col. Robert H. Baskett

345 TAS/CC
Lt. Col. John W. Brooks

14 MAS/CC
Lt. Col. Steven A. Roser

15 MAS/CC
Lt. Col. David J. Semon

75 MAS/CC
Lt. Col. Kenneth L. Wildung

HQ MAC/DOV
Lt. Col. James G. Hathcoat
Maj. Michael T. Barnes
Maj. Edward M. Cook
Maj. Clyde O. Minish
Maj. Roger C. Muirhead
Maj. William W. Ross
Maj. Hamilton S. Stewart, Jr.
Maj. Francis J. Waller, Jr.

97 MAS
Maj. Steven M. Allen
Maj. Duddley W. Boone
Maj. Gerald R. Burnett
Maj. Donald L. Davis
Maj. John B. Gannon
Maj. Jeffrey L. Hubner
Maj. Larry E. Kangas
Maj. Dennis G. Kirby
Maj. Ronald J. Knutson
Maj. Kenneth E. Lanier
Maj. Daniel L. Matthews
Maj. Bruce K. McRae
Maj. Mark A. Norelius
Maj. James B. Reinertsen
Maj. Gary R. Robbins
Maj. Thomas E. Anderson
Maj. James R. Aversman
Maj. Douglas A. Blechschmidt
Maj. Paul J. Buckholtz
Maj. Clifford E. Dunn
Maj. Jeffrey N. Fine
Maj. Thomas Gonzalez
Maj. Lynn J. Kern
Maj. Rodney J. Lalley
Maj. Richard H. Lauer
Maj. William A. McKenzie
Maj. Thomas W. Mosley
Maj. John J. Nance
Maj. Robert D. Ormsby
Maj. Vernon B. Jeremica
Maj. Robin S. Rothermel
Maj. Thomas O. Short
Maj. Ronald L. Wilhelmson
Maj. Mark R. Sanders
Maj. John G. Stott
Maj. Mark J. Taylor
Maj. Thomas T. Wiggin
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Capt. Steven M. Allen
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Capt. Wendell L. Nissing
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MSgt. Gary M. Horton
MSgt. Jerry L. Kohlman
MSgt. Charles E. Priddle
MSgt. Jerry A. Roperwitt
MSgt. John R. Campton
MSgt. Ricky L. Iben
MSgt. Erik H. Kuzniczi
MSgt. James H. Myhre
MSgt. John R. Stromness
TSgt. Lawrence R. Redelsperger
SSgt. Mark L. Lindsay

Ranks and units are those at time of award.

NORTON AIR FORCE BASE, TH

A "Class Act" Demonstration o

By Capt. Dan Doug
Associate Editor

Norton Air Force Base is located in the southern California city of San Bernardino, 60 miles east of Los Angeles. The Army Air Force selected this San Bernardino Valley location for a logistics depot in 1941. With mountains behind it, and desert in front, the location was excellent—for a supply depot that is.

Established with Starlifters at Norton in April of '67, the 63d immediately swung into action supporting U. S. forces in Vietnam. They were also the prime mover of Bob Hope's worldwide Christmas Tours during those years. The wing capped its record of can-do performance by flying the first C-141 into Hanoi after the cease-fire to airlift the first 40 POWs to freedom.

This region of the United States provides a great training environment, with a gracious plenty of high mountains, desert flats, and open ocean. Furthermore, Norton's mission, capability, and location lead to a high emphasis on airdrop missions and exercise participation. The key words here are worldwide capability, and I *mean* worldwide.

When I asked several crewmembers what they liked most about Norton and the C-141, consensus (without collaboration), was their Starlifter's long legs, its air refueling capability and, most of all, their wing's capability to deliver the goods. Additionally, some boasted of their capability to perform tactical, strategic, or humanitarian missions. This is a place where they indeed practice their wartime mission during peacetime.

A recent example of Norton's desire to practice their trade was in GALLANT EAGLE 88. Norton provided 15 of 35 participating C-141s. The Starlifters came from 5 MAC wings and 4 departure bases and dropped simultaneously on two drop zones 3 miles apart with a midnight TOT. A "class act" demonstration of Starlifter capability.

What special or unique challenges affect Norton? I learned a new term here: Aluminum Showers Forecasted. This is the "term" used to describe the location's high potential for midair collision—a *very* high potential. This section of CONUS airspace combines three serious aviation hazards (leaving one wondering how in the world there aren't more "Aluminum Showers"). Those three are air traffic density, poor visibility, and mountainous terrain.

The area is a geographic funnel between

Norton's Base Operations

mountains and ocean. A variety of hazards runs from solo students to jumbo jet air carriers, and they come in such numbers! Imagine 40 airports within a 40 mile radius. Ontario, the area's air traffic control facility, is a Level IV, soon to be Level V facility. Now, if that means as little to you as it did to me when I heard it, let me tell you how Mr. David Fowler, Assistant Manager for Programs at Ontario TRACON, explained it.

A Level III ARSA is one in which air traffic control handles 27 to 60 planes per hour (pph). If you'll recall August 88's *TMF* article about McGuire AFB, we reported that base as a Level III facility and highlighted that McGuire's airspace was, indeed, busy. Increasing along the spectrum, Level IV ARSAs equate to 60 to 99 pph, and Level Vs are 100

, The 63d Military Airlift Wing

ration of Starlifter Capability

Dan Dougherty
iate Editor

63 MAW Starlifter

Transit Galaxy Awaits Exercise Load

and above. In fact, Mr. Fowler told me Ontario TRACON handled 4.8 million aircraft in the 1986-87 period equating to 1,700 planes per day. Now the number is up to 1,968!

While trying to comprehend just how staggering the Norton area air traffic is, keep in mind those figures are an average. In other words, midnight to 0600 daily, and Saturday afternoon to Sunday morning, are very slow. And a final note, hang glider activity is also on the increase with some reported flying as high as 12,000 ft MSL.

Once you understand the magnitude of the air traffic volume, take a closer look at other factors making it even more challenging. For example, Norton and Ontario International share the same final approach fix (FAF). Norton has four published instrument approach procedures (IAPs), all of them to Runway 6. Both the Cat I and II ILS have Pettis NDB as the FAF, with a mandatory altitude of 3,200 ft MSL. Of the two remaining nonprecision approaches, one is the NDB, Pettis again, and the other, the TACAN, follows a similar ground track.

A little more than 20 miles west of Norton is Ontario International Airport. Of Ontario's five published IAPs, three of them, the NDB Runway 26L, the ILS Runway 26L, and ILS Runway 26R also use Pettis NDB for an FAF, with a minimum altitude of 4,200 ft MSL at the fix.

If I didn't emphasize this hazard enough, let me put it this way—there is opposite direction IFR traffic simultaneously using the same point in space with 1,000 ft altitude separation. Now, while this may sound frightening, it's really not that dangerous. But it certainly emphasizes the high degree of diligence required by both air traffic controllers and aircrews, particularly when you realize the aircrews are as diverse, experience-wise, and the aircraft as dissimilar, speed and size-wise, as they possibly can be.

I don't know for sure why Norton doesn't have an IAP to Runway 24, but, I can well imagine it has something to do with terrain. Another major challenge to flight operations in the vicinity of Norton's airspace—there're rocks in there! In fact, there's terrain rising 850 ft above 24's threshold altitude within 4 miles, and it peaks to almost 7,000 ft within 15 miles. For an instrument approach to 24, you'd need one heck of a rate of descent on final. Furthermore, the San Gorgonio Mountains peak at 11,502 ft MSL a mere 23 miles east of the base.

High traffic volume and terrain, if that ain't enough, add one more challenge to this airspace—visibility. It's spelled S-M-O-G, and it's one of Southern California's most talked about problems. I didn't actually see those mountains I spoke about earlier. In fact, some of those assigned to Norton tell of people assigned there for months who haven't seen them yet! They quickly admitted to an exaggeration, but only by a little.

The good news is that California's tough anti-pollution laws are showing remarkable results and visibility restrictions due to smog have have improved considerably in the last five years. The bad news is that in the summer it's still around 3 miles

and, on some days, worse. All told, once air traffic and terrain problems combine with visibility restrictions, we have quite a recipe for collision.

To avoid complacency at a place where near misses are routine, the 63d safety folks keep this subject on the table, making sure it's discussed at every safety meeting. Norton aircrews are serious about clearing and keeping as many eyes out the windows as crew duties allow. Furthermore, they get as much briefing and planning as possible out of the way prior to arrival because they know they'll be into a flurry of traffic calls and clearances as soon as they get near home.

Gee Whiz Starlifter Facts

1. The C-141B is the "work horse" of the Military Airlift Command. The Starlifter is capable of airlifting more then 60,000 pounds of cargo on 13 pallets, or 200 fully equipped troops, or 155 paratroops, or 103 litter patients plus attendants.

2. The plane has an operating weight of 149,000 pounds, and a maximum ramp gross weight of 325,000.

3. Its maximum cruise speed is 566 mph, and has a range, with maximum payload, of 2,293 miles. The range increases significantly when air refueling.

Quite an interesting place to call home, but what about their mission? Norton crews are deeply involved and enthusiastic about combat aircrew training. DOV flight examiners told me the crews are doing some innovative things with combat training. Their job is making sure they take a common sense approach and continuously maintain situational awareness.

The wing's primary operational area is no piece of cake, either. The Pacific theater demands a lot of aircrew stamina, due to the vast distances involved. The most common challenges are sleep cycles, exotic destinations, and fuel concerns.

We hear a lot about scheduling adequate crew rest and circadian rythms. Yet these crews live in constant challenge when it comes to this scheduling. But the problem is not exclusive to Norton; our entire strategic fleet manages this risk continually. This is the downside of the "long legs" capability. Complaining about it isn't a solution— planning for it is; and 63d crews do just that. It's part of route planning, not only while airborne, but while in crew rest.

For an aircrew member, Norton is a great flying assignment because of an interesting variety of destinations. Norton crews really span the globe; from Europe to the Middle East and Africa; from Canada and Alaska to South and Central America; and from Korea to Antarctica, 63d crews routinely fly there.

Going someplace you've never been can indeed be exciting, until you launch from Runway 24 at Andersen into the "black hole" and discover what spatial disorientation really is! The thrill is worth it though, as Norton crews gladly step up to this challenge by doing their preflight homework and communicating with one another. They're quite successful at it, in fact, and the record proves it. One of the four flying squadrons, the 14th Military Airlift Squadron, has logged over 650,000 flight hours; that's over 32 years, without a mishap.

Another challenge to long flights across the broad ocean area is fuel planning. Our planet didn't provide transpacific air travelers too many opportunities to build weather observation stations between Hickam and Christchurch. Satellite data and aireps can sometimes lead a crew down a dead end path in the winds aloft forecast. Once committed, even equal time points can become inaccurate, and diverting can become a *non-option*.

But, we haven't lost a MAC crew to this hazard—a remarkable tribute to those who designed the charts, wrote the restrictions, and most importantly—use them to fly the airplane. But as we all know, that's not to say some of us haven't come close! Many an anxious hour has been spent wondering if the chart is really going to match fuel flow, and every minute of those hours takes its toll in stress.

The final and most serious challenge facing Norton today is one the rest of our Air Force is also grappling with—keeping a highly experienced crew force. Our Vietnam era crewmembers are reaching retirement age, and our mid-level experienced crew force is dwindling faster than we can age replacements. With this dilemma, our commanders, ops officers, and stan/eval types are placed in a position where quality crew training has become the most important goal, with careful crew scheduling running a close second.

The final tally on how we'll get through this period is not in yet, but Norton can proudly point to their successes. The base conducts a worldwide flying mission out of probably the busiest airspace in the world. They circumnavigate the mountains and do it without the aid of a clear day. Without fanfare, the 63d Military Airlift Wing supports the nation's worldwide commitments and clearly lives up to their nickname: "The Professionals."

Excellence in Airmanship

Maj. Edward L. Horne, Jr., and Crew, 305 ARRS, Selfridge ANG Base, Michigan, had just accomplished a normal touchdown when their HC-130N suddenly swerved left—the left horizontal landing gear torque strut had snapped in half between the wheels. Major Horne applied full right rudder and assymetric reverse, although the aircraft continued to drift left.

The loadmaster, MSgt. William T. Shaw, reported smoke pouring out of the left wheel well, and MSgt. Russell J. Clyne, FE, smelled smoke in the cockpit. As the C-130 continued its slide to the edge of the runway, Major Horne and Maj. Danny R. Blackburn, copilot, managed to keep the aircraft nose straight. As they slowed to about 60 knots, Major Horne engaged nosewheel steering which, combined with assymetric reverse, finally stopped the drift. The C-130 finally came to a full stop, leaving a 2,600-ft skid mark on the runway. Damage was limited to the wheels, wheelwell, and sheet metal.

Major Horne and crew displayed outstanding airmanship and professionalism during this emergency. We at *TMF* applaud their actions.

Zero Saves Over Sachon

Everybody remembers their first rescue as an AC!

By Maj. Keith Curtis
HQ MAC/IGFF, Scott AFB, Illinois

For every helicopter pilot, the first rescue mission as an aircraft commander is a memorable one. You immediately realize the awesome responsibility you've been entrusted with—for your crew, your aircraft, and people in distress whose very lives depend on you. It really gets the heart pounding and the adrenaline flowing. It's a feeling you experience every time you hear the klaxon go off or get that phone call launching the alert helicopter. For me, my first rescue mission as an aircraft commander may have been a little too memorable. Nine years later, I can still remember that mission as if it were only yesterday.

I was a newly-minted aircraft commander. So new that my buddy rides had to wait until my arrival at Osan AB, Republic of Korea. Detachment 13, 33d Aerospace Rescue and Recovery Squadron (now the 38th ARRS) was hurting for aircraft commanders and wasted no time getting me checked out locally. As soon as I was blessed, they put me on weekend alert. That particular weekend, the det was having a BBQ chicken cookout at the Jolly Green enlisted barracks. Cookouts were no small feat in those days. You had to drive to Seoul to buy chicken at the Army commissary and pool ration cards to buy enough beer. Of course, as the alert crew we had to pass on the beer, but it was a warm, summer Saturday afternoon and we were enjoying the cookout, anyway.

We hadn't been at the cookout long when word came to launch the alert helicopter. While we were enjoying warm sunshine at Osan, the southern Korean peninsula was flooded by a torrential downpour from a tropical storm off the Korean coast. The South Korean government requested we assist in evacuating people stranded by the floods. We piled into the alert truck and drove to the hangar. There, I quickly changed into my flightsuit, leaving my civilian clothes in the office. A weather check indicated we could expect to encounter heavy rains south of Taegu with marginal VFR ceilings. They couldn't tell us much more due to lack of weather-reporting facilities in that part of the country. We were also told we would be under operational control of the Republic of Korea Air Force (ROKAF), who were coordinating rescue efforts.

We planned to fly direct to Taegu then follow the Naktong River to Sachon AB, a ROKAF base in the flood area. There, we would refuel and receive further intructions. The HH-3E was cocked and ready to go on the hot spot—we were airborne less than 20 minutes after initial notification.

The flight to Taegu was uneventful. The weather was good, much like that at Osan, and we were somewhat amazed that the weather could be so bad just a little further south. As we flew south from Taegu, ominous clouds began forming. As the terrain rose, the ceiling dropped. It wasn't long before we were flying along the river bed at 50 KIAS and 50-100 ft AGL, with steep, rising terrain on both sides of the river.

As I flew, my copilot stayed glued to the map, navigating—no easy task with the mountains tops obscured in clouds and visibility less than half a mile. Fortunately, I was blessed with a highly experienced crew and we were working well together. With low altitude and visibility, we were very concerned about avoiding powerlines. In Korea, powerlines were the greatest hazard we faced. They were strung all across rivers and valleys, just waiting to snare a careless helicopter or low-flying fast mover. What's more, they were going up so fast that many were uncharted and not in the CHUM. My backenders were scanning the ridgelines for towers. My copilot would announce when we were approaching wires on the maps. We could barely climb over the wires and stay out of the ragged cloud base. If at all possible, we wanted to avoid going IFR. We didn't want to risk flying into severe weather with fuel critical. I asked my copilot to keep calling out emergency safe altitudes for the sector we were in, should we go inadvertent IMC. I told my crew that if anyone felt uncomfortable with what we were doing, to "sing out" and we would get out of there. We envisioned hundreds of people trapped on rooftops needing to be hoisted to safety. We didn't want the weather to stop us from helping them. My crew encouraged me to press on.

About halfway to Sachon, we were confronted with another problem. Up ahead, we spotted an Army UH-1 heading down river, also on its way to Sachon. We established radio contact and advised him we would follow. He was flying slower than us,

"We envisioned hundreds of people trapped on rooftops needing to be hoisted to safety."

forcing us to slow down, also making power more critical. There wasn't enough room to pass him. Now we had to keep our eyes on him *and* the terrain. Visibility was getting really bad. It was raining so hard the windshield wipers couldn't keep the windows clear. We kept our windows open so we could see outside. I covered my pilot's console with rags to prevent water getting into the Automatic Flight Control System. Suddenly, the Army pilot announced, "I have wires ahead of me and I can't see over them, we're setting down." He started descent toward a sandbar in the river and we had no choice but to continue on. There wasn't enough room for us to land and we couldn't turn around. At our low speed and heavy gross weight, it took all the power we had to climb over the wires. We were passing through the ragged cloud deck as the wires slipped below us. We were barely able to see the ground. I continued straight ahead, thinking I was still following the river, when in fact it was a flooded valley. The river had taken a 90-degree left turn at the wires. My copilot indicated the river was to our left. I said I couldn't see it and passed him the controls to make the turn and stay clear of the terrain. Back safely on the river, I resumed control of the aircraft and he returned to navigating. We felt it was easier for one person to stay on the map rather than switching navigating responsibilities back and forth and chancing getting lost.

As we continued down river, concern over our fuel state and remaining daylight grew. The flight was taking longer than planned because we were forced to follow every bend in the river at low airspeed. We had taken off at mid-afternoon and it was getting late. Darkness was fast approaching, with heavy cloud cover blocking out much of the available sunlight. We had been trying to avoid going IMC, but were now faced with the possibility of having to go IMC anyway to make Sachon with minimum fuel. We didn't have radio contact with anyone at such low altitude, and didn't know what the weather was at Sachon. There wasn't enough fuel to make an alternate; if we went IMC, we'd be committed to land at Sachon. We breathed a little easier when we finally flew past the city of Chinju, knowing we should be able to land at Sachon. Ceilings were improving, although the rain was still heavy. Flying over Chinju, we didn't see anyone in distress. Our vision of people trapped on rooftops didn't materialize, but from the looks of flooding in the surrounding areas, we figured there were many villages in the countryside flooded or in the path of possible mud slides. We anticipated a busy next day ahead of us. It was too late to attempt any rescue operations—it was nearly dark and we needed fuel.

As we approached Sachon, we could see a ROKAF UH-1D performing some kind of a hoist operation near the base perimeter. Our fuel low level caution lights were blinking as we landed and taxied to the ramp. A lot of ROKAF folks stood alongside the buildings watching us. They were dressed in assorted combinations of uniforms and footwear. The ramp was under a couple inches of water. Sachon AB is on the coast with a seawall off the end of the runway. Rains and high seas from the storm had flooded the base. We jumped out in the pouring rain and began to secure the helicopter, tying down rotor blades, doing the post flight inspection, and refueling. We had to keep a close eye on all the activity around the aircraft. The fuel truck probably would have run into our rotor blades had we not seen him at the last minute and stopped him. During fueling, the Army UH-1 landed—they had seen us clear the wires so decided to take off and follow us about five minutes later. I was glad *we* hadn't had to follow *them* to Sachon. We probably wouldn't have had enough fuel to make it.

The ROKAF commander and Flight Wing Commander drove out to meet us. They said they were setting up sleeping quarters for us and would take us into town for something to eat. We piled into their jeeps and drove off base hoping to find a restaurant still open. The town was partially flooded and without power, but after a couple of stops we found a restaurant able to feed us. The two ROKAF colonels joined us for dinner. There we sat, on the floor, soaking wet, realizing we had very little money and no dry clothes to change into. (In my haste to scramble, I'd left my wallet in my civvies back at Osan.) We had egg drop soup, BBQ chicken, kimchee, and soft drinks. I managed to spill a bowl of scalding soup on my copilot's leg. The dinner was excellent and our Korean hosts picked up the tab.

After dinner, they took us back to base and since

Sachon didn't have sleeping quarters, we were provided with cots set up in one of their classrooms. They also provided towels but after one look at the bathing facilities, consisting of a small, tiled tub in the corner of the restroom filled with cold water from who knows where, we decided to pass. That is, except one of the PJs, who had been in Korea so long nothing fazed him.

We woke the next day anxious to get on with rescue operations. Our flightsuits were dry, if not exactly fresh smelling. Neither were we for that matter, all of us sporting one-day growth of beard. We were taken to the dining hall for a breakfast of fried eggs, rice, and kimchee, the ROKAF colonels once more hosting us. While the flight mechanic (now flight engineer) and PJs readied the aircraft, my copilot and I went to base ops to find what needed to be done. Base ops was nearly bare, with only a couple hand-cranked field telephones behind the desk and some notices printed in Korean. We waited and waited for word to launch. Nothing came. We grew restless. Surely with all that flooding there had to be villages in need of assistance. If the ROKAF hadn't received specific requests for assistance, we suggested we might fly around the area looking for people in distress. The weather had cleared enough for us to fly anywhere. Finally, around noon, we were told there were five people trapped under a bridge at Miryang, northeast of Sachon. Since a hoist was required, we took the mission and launched.

We were excited about finally getting to do something. All the way there, we discussed what we would do once on scene. We were ready. We found the bridge, but no people. The bridge came out right from the center of town. There were many folks walking along the streets or standing along the river drive, waving to us, but none appeared in distress. We searched up and down river from Miryang with no results. Anyone in trouble had long since been rescued.

We decided not to return to Sachon but to fly north to Taegu AB. We figured it would be easier to coordinate rescue activities from there, since it was a joint ROKAF/USAF base. We arrived late afternoon and were instructed to go into crew rest and maybe there would be something for us tomorrow. We checked in at Billeting only to learn there were no rooms available. There was an exercise in progress and all rooms were full. We found rooms at the Han-Il hotel, a nice western-style hotel in Taegu.

It took most of the money we had to pay for two rooms for one night. We spent what was left on some fruit and snacks for dinner. We were an odd collection of ragged, weary warriors who strode into the lobby. At least we could take a hot shower and shave, (my copilot had a disposable razor). We still couldn't do anything about our ripe flightsuits, so we left them standing in the corner. We wondered if we shouldn't have gone back to Sachon. Conditions were grim there, but at least the Koreans had tried to make us as comfortable as possible (and we also didn't need any money there).

The next day was a repetition of the previous day. We waited and waited for word to launch. We weren't being used for anything, yet we hadn't been released. My crew laid out on the ramp by the helicopter, soaking up sun. Finally, around two o'clock, we were released. Disappointed, but glad to be going home, we took off for Osan, bringing our nearly two-and-one-half-day rescue odyssey to an end.

We had flown through terrible weather conditions, in unfamiliar mountainous terrain, and endured personal hardship, all with hopes of being involved in a major rescue operation. As it turned out, we saved no one, but we learned a lot. After that mission, everyone on alert packed overnight bags and carried extra cash. It proved handy more than once.

I was a young aircraft commander, but this mission rapidly matured me. The value of good crew coordination and crew experience was really brought home to me on this mission. *We can't do it alone.* It took a total crew effort to fly, navigate, and scan for obstacles in low ceilings and visibility. I learned how difficult it is to predict weather in remote, mountainous areas, and to always take this fact into account. Always leave yourself an out. We can't always just turn around and go back the way we came. We were lucky. We could have easily ended up under IFR, in bad weather, minimum fuel, without an alternate, after dark. We learned the difficulties of working joint operations and staying alert when operating at an unfamiliar base. We also learned how courteous and grateful Koreans are for our assistance. They bend over backwards to help and try to make the best of a bad situation. They demonstrated this time and time again and we had nothing but respect for them.

About a week after the mission an article appeared in the *Stars and Stripes* about an Army UH-1 rescuing 180 folks stranded on an island. It had to be "our" Army UH-1 at Sachon. We took a lot of good-natured kidding about the mission after that. When I left Osan in July '80, I was presented the traditional brass cyclic stick grip. Along with my name and date was the inscription "0 Saves over Sachon." That momento still sits with pride on my desk, a constant reminder of one of the most difficult missions I've ever flown, and the valuable lessons I learned.

A Matter of Non-Compliance

The first line of defense failed.

Aviation is one of the rare occupations that requires you to write things you do repeatedly in checklist form and commit to memory things you must do occasionally or never at all. But, it's precisely the mundane nature of the "everyday" tasks required to prepare an aircraft for flight, and failings of human memory, that generated the need for aircraft checklists and the requirement for vigorous checklist compliance by crewmembers. Relying on outside cues or mechanical backups to initiate and ensure compliance isn't an acceptable alternative for strict, timely checklist initiation and compliance.

Unfortunately, the need for exacting checklist compliance was tragically demonstrated 16 August 1987 when Northwest Airlines, Inc., Flight 255, crashed shortly after takeoff from Runway 3 Center at Detroit Metropolitan Wayne County Airport, Romulus, Michigan. Flight 255, a McDonnell Douglas DC-9-82, was a regularly scheduled passenger flight en route to Phoenix, Arizona. According to witnesses, Flight 255 began its takeoff rotation about 1,200 to 1,500 ft from the departure end of the runway and lifted off near the end of the runway. After liftoff, the airplane's wings rolled left and right about 35 degrees in each direction. The airplane collided with obstacles northeast of the runway when the left wing struck a light pole 2,760 ft beyond the end of the runway. Thereafter, the airplane struck other light poles, the roof of a rental car facility, and then the ground. It continued to slide along a path generally aligned with the takeoff runway's extended centerline. The airplane broke up as it slid across the ground and post-impact fires erupted along the wreckage path. Three occupied vehicles on a road adjacent to the airport and numerous vacant vehicles in a rental car parking lot were destroyed by impact forces and/or fire. Of the persons on board Flight 255, 148 passengers and 6 crewmembers were killed; only one passenger, a 4-year old child, survived. On the ground, two individuals were killed, one seriously injured, and four suffered minor injuries.

Flightcrew Checklist Performance

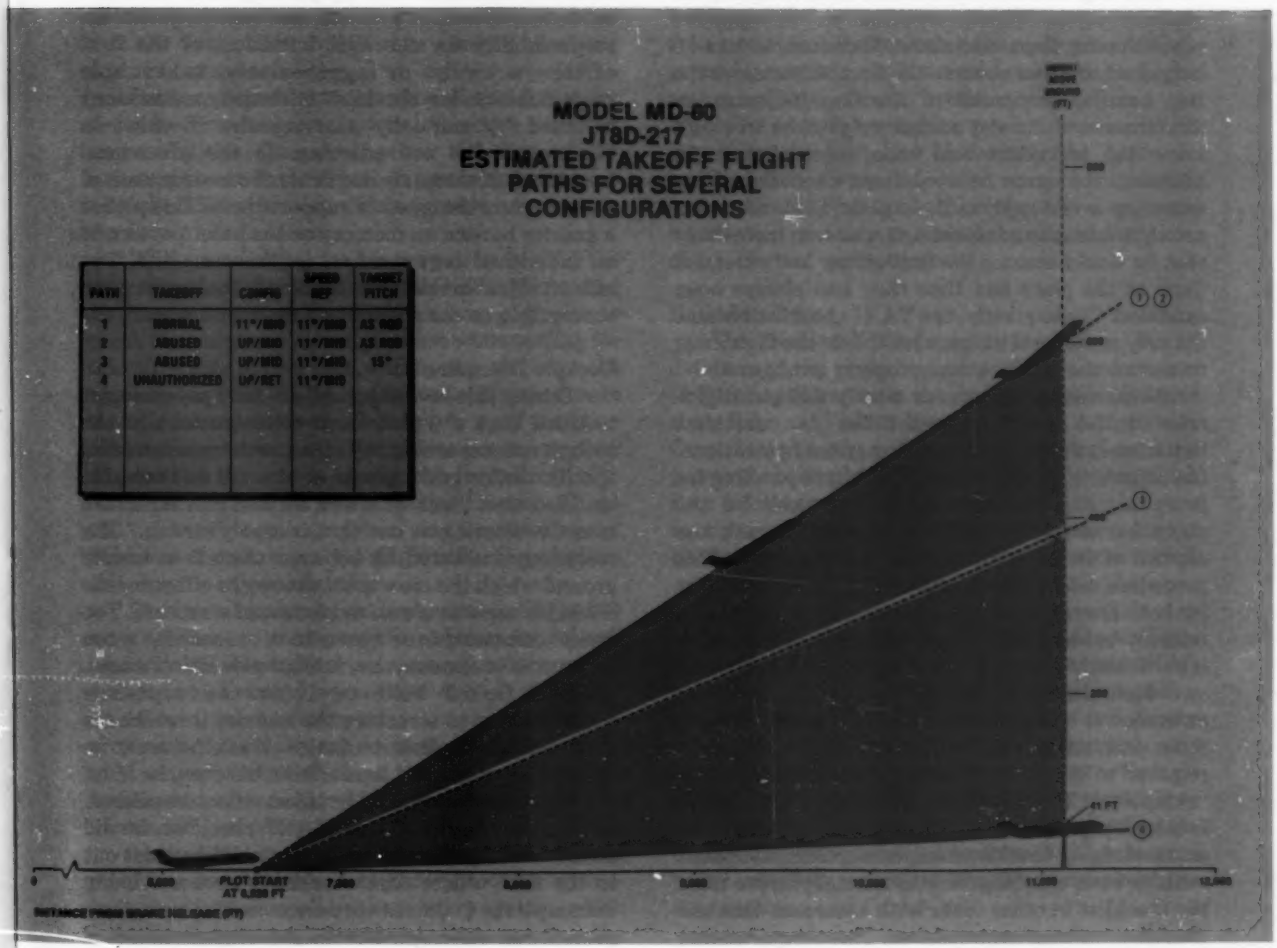
During its accident investigation, the National Transportation Safety Board (NTSB) discovered the crew failed to extend flaps and slats to properly configure the airplane for takeoff. According to the cockpit voice recorder (CVR), the flight crew neither called for, nor accomplished the TAXI checklist. The first item on the TAXI checklist required both pilots, in response to the checklist's challenge, to check and verify orally that flaps and slats were positioned correctly. This item was not performed, and the flightcrew did not discover that the airplane was improperly configured for takeoff.

Omission of the TAXI checklist was further corroborated by the flightcrew's inability to engage auto throttles at the start of takeoff because they did not, as required by the TAXI checklist, place the Thrust Computer Indicator (TCI) in the "T.O." mode. The TCI provides EPR limit values for six flight modes (takeoff, go-around, reduced thrust takeoff, maximum continuous thrust, climb, and cruise) based on temperature. However, they rectified this omission by the time they accelerated to 100 KIAS.

Once takeoff roll began, however, there was little chance they would detect any of the visual cues—flap indicators in the up position, absence of the blue takeoff light on the slat indicator panel, and absence of the Automatic Reverse Thrust (ART) ready light—that might have alerted them that the airplane wasn't properly configured. During takeoff, the ART system provides automatic engine failure detection and a subsequent thrust increase on the operating engine. All visual cues relating to flaps and slats were located outside, or on the periphery of, those normally monitored by the captain and first officer during takeoff.

The NTSB could not conclusively determine why the first officer didn't lower flaps. Northwest's procedures authorized first officers to extend flaps after the airplane begins to taxi and has cleared the parking ramp and its associated obstacles. The CVR recording indicated that during the period when the first officer was authorized to lower flaps, several events might have diverted his attention. Almost immediately after receiving taxi clearance, and about the time the airplane began moving, the first officer had to select the ATIS radio frequency and listen to and copy the ATIS message. After receiving the message, he had to get the takeoff performance chart and verify they could use Runway 3 Center for takeoff. Their dispatch package was based on using either Runways 21L or 21R. Runway 3 Center was the shortest of the three available runways. Thus, he possibly might have intentionally delayed lowering flaps, perhaps anticipating a different flap setting due to the runway change.

Northwest pilots testified the flap extension procedure was a very strong habit pattern among DC-9 first officers. If such was the case, the first officer may never have experienced an occasion when he had either inadvertently failed to extend flaps or had failed to extend them when the airplane began taxiing. The habit pattern of extending flaps may have caused a lessening of his awareness of the omission because by the time he completed copying the ATIS message and analyzing takeoff data, the



"The NTSB could not conclusively determine why the first officer didn't lower flaps."

airplane had taxied well beyond the point where he would have routinely extended flaps. Based on this well-developed habit pattern of extending flaps, the first officer might have believed that this task, always completed shortly after the captain began to taxi, or by the time the airplane departed the terminal ramp, had been completed, as always.

The flap extension procedure didn't require the captain to be either notified or to approve repositioning flaps and slats. Therefore, unless he happened to either observe the first officer move the flap handle, movement of the flap indicator, or illumination of the slat advisory lights, he wouldn't know the procedure had been accomplished. In addition, the same habit pattern concerning flap extension would apply to the captain. Since there was no requirement to advise him, it was even more likely that he would assume the first officer had extended flaps at the place and time they had always been extended. Consequently, the TAXI checklist became the only procedural means available to the flightcrew to ensure the airplane was properly configured.

Northwest's procedures clearly defined flightcrew duties and responsibilities for checklist initiation and completion. During ground operations, the captain is to initiate each checklist by calling for it by name; if the captain does not call for the checklist, the first officer is required to ask the captain if he is ready to run the checklist. This procedure establishes positive entry into a checklist for both crewmembers and provides crew backup to memory-based initiation of a checklist. This design is particularly critical in initiating the TAXI checklist on which the flaps are the first item, since flap extension is solely the first officer's responsibility. After each checklist is completed, the first officer is required to identify the checklist and state that it is "complete." The statement that a specific checklist is complete provides closure to checklist conduct by acknowledging checklist completion. This statement enables both crewmembers to mentally move from the checklist to other tasks with assurance that the checklist has been accomplished. These requirements were met only once during pre-takeoff checklists. The closest approach to these standards was the BEFORE START checklist. At 2029:10, the first officer challenged "Brakes," the first item on the checklist. The captain didn't respond to the challenge; however, at 2029:18, the captain said, "Let's do the checklist." At 2032:54, the first officer announced, "The BEFORE START checklist is complete." However, even with performance of this checklist, there were failures to comply with company standard procedures. Checklist items which require actions by and responses from the captain were read and responded to by the first officer. The captain did not call for the AFTER START, TAXI, or BEFORE TAKEOFF checklists, nor did the first officer ask the captain if he was ready to perform any of these checklists before reading the items.

The NTSB believes the goal of procedures used to design a checklist is to establish a process wherein both crewmembers actively participate in checklist initiation. When, in practice, the captain yields his responsibility for checklist initiation, or the first officer actively or aggressively takes sole responsibility for checklist initiation, redundancy afforded by mutually starting the checklist is eliminated. By not adhering to the procedural framework, the captain and first officer compromised the structure designed to support them. This placed a greater burden on memory or the habit pattern of an individual crewmember, in this case the first officer. This breakdown rendered the crew more susceptible to distractions or memory lapses.

Cockpit Discipline

During this investigation, a NASA psychologist testified that a well defined role structure in the cockpit reduces ambiguity about each crewmember's specific duties and when he or she will do them. He testified that "lack of a well defined role structure is as devastating as one that is overly strong." His testimony indicated he believed there is a middle ground which the crew must occupy in effecting the desirable aspects of role or command structure. Too many commands, or commands issued in a too authoritative manner, may inhibit crew effectiveness.

The Board believes it is the captain's responsibility to structure the manner in which his crew will accomplish its duties. While he must be open to informational inputs from his crew, he must set the tone for how this information is offered. Except for the BEFORE START checklist, he did not call for any other checklists, nor did he point out to the first officer that checklists were not being accomplished in accordance with company procedures. After pushback, the captain initiated

three conversations not germane to duty requirements and diverted the crew's attention from task-related activities.

Evidence indicated that the first officer was either given, or assumed he had been given, the duties of leading the crew's task-related activities up to and including signing the flight release, a responsibility assigned to the captain by regulation. (The copilot signed the release while the captain was doing a walk-around.) The first officer's assumption of the role of leader placed him in a position of structuring the crew's approach to activities while at the same time trying to assure the captain he was carrying out his subordinate role in a satisfactory manner. In the area of checklist initiation, the first officer's assumption of initiation responsibilities greatly increased his work and planning load and relegated the captain's function to that of observer.

Evidence also indicated that deference by a captain to a first officer can also inhibit crew effectiveness because the captain cannot presume that the first officer will always assume all of the captain's responsibilities. The captain appears to have become dependent upon checklist initiation by the first officer, instead of on his own active initiation responsibilities. Therefore, when the first officer became distracted, the captain's passive involvement with checklist initiation didn't provide a backup to the first officer's memory.

While conducting its investigation, the NTSB interviewed other Northwest DC-9-82 pilots and discovered some use the takeoff warning system to check their airplane's configuration while taxiing for takeoff. Pilots stated that, during taxi and after the airplane has been configured for takeoff, one or more throttles are sometimes advanced to see if the takeoff warning annunciates. If there is no warning, they assume the airplane is configured for takeoff. The Board found that, for an unexplained reason, Flight 255's takeoff warning system was inoperative and therefore didn't warn the flightcrew the airplane wasn't properly configured.

The Board couldn't find any evidence Flight 255 crew's failure to configure the airplane for takeoff was attributable to their reliance on an automated system which would warn them of their omission. The Board did, however, receive testimony from a professor of management sciences at the University of Miami who testified about the effects automated systems in advanced modern airplanes appear to have on flightcrew performance.

He testified that research projects had identified a phenomenon which researchers called the "primary backup inversion where the primary system, which is human vigilance, becomes the backup, and the backup system, the machine, becomes the primary." He cited, as an example, the altitude alerting system which, during climb or descent, is programmed to provide an alert to the flightcrew 700 ft above or below inserted level off altitude. Virtually all air carrier procedures require the nonflying pilot to provide a 1,000-ft-to-go alert call to the pilot flying. He testified that "it doesn't work that way. So what do you see climbing or descending? The pilot will sit there . . . until the altitude reminder sounds (and then) say a thousand to go. That's the primary backup inversion. He has used a backup system to human vigilance and made it the primary system and then he reacts."

The professor described six lines of defense against an untoward consequence resulting from human error. The first line of defense was human vigilance; the second, another crewmember detecting error; the third, secondary indications, such as cockpit displays and instrumentation; the fourth, warning and alerting devices; the fifth, persons other than crewmembers detecting the error, i.e., ATC or ground personnel; and the sixth, machines that take action on their own to rectify the error, i.e., the DC-9-82's autoslat and stick pusher systems. With regard to the first line of defense, the professor testified that it was, *"of course, normal procedures, and that is the crew doing the right thing, supported by checklist, training, experience, manuals, discipline, check airmen, and what not."*

Probable Cause

The National Transportation Safety Board determined the probable cause of the accident was flightcrew failure to use the TAXI checklist to ensure that flaps and slats were extended for takeoff. Contributing to the accident was absence of electrical power to the airplane takeoff warning system, which thus did not warn the flightcrew the airplane was not configured properly for takeoff. The reason for the absence of electrical power could not be determined.

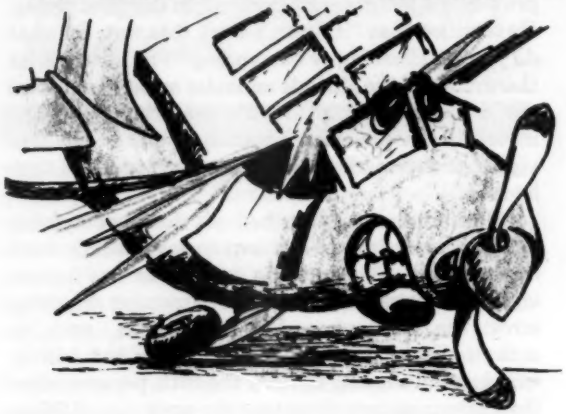
Application to MAC

No MAC airplanes are flown solo. They all rely on each crewmember functioning to the best of his or her ability while backing up and supporting fellow crewmembers. However, there is only one person with ultimate responsibility for the aircraft's safe operation—the aircraft commander. Aircraft commanders must do just that—command. They can't allow that responsibility to be assumed by the copilot, flight engineer, loadmaster, ATC, command post controllers, or a black box. *There are simply no alternatives.*

Adapted from: *NTSB/AAR-88/05*

QUICKSTOPPERS

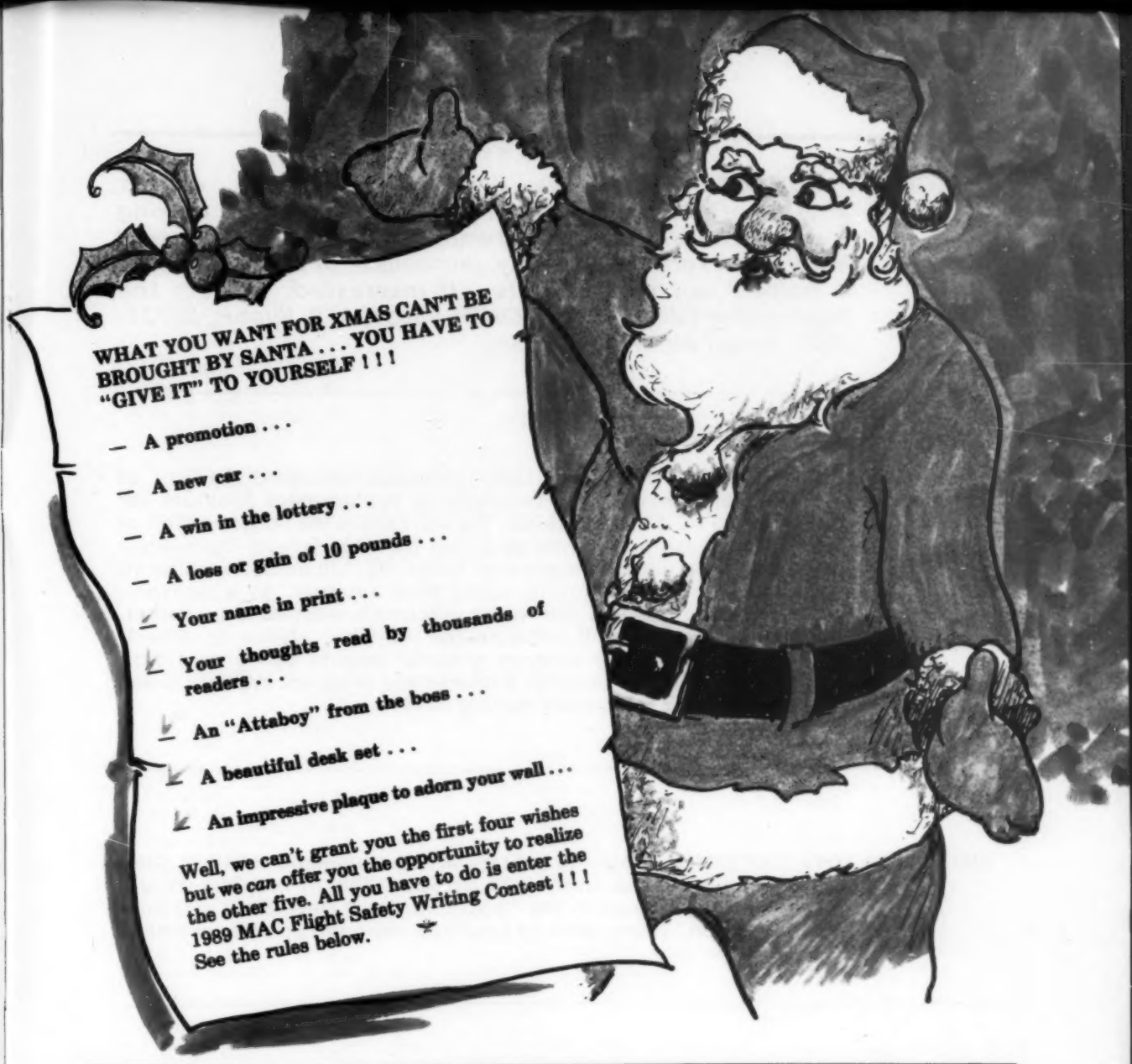
WE BLEW THEIR DOORS OFF!



The civilian ramp was heavily congested with aircraft, and the airfield manager had directed the C-5 be marshalled to park near a cluster of small civilian airplane hangars. To exit the area, a right turn out of parking was necessary to safely clear a light pole situated to the left of the aircraft. After being cleared to taxi, the pilot added minimal power and started a right turn to avoid the pole. One of the scanners noticed the doors on a small hangar behind the aircraft were moving, and then the jet blast blew two of the hangar doors off their tracks. One door fell to the ramp and the other fell on a civilian airplane. The ramp area where the C-5 was parked is not normally used by MAC aircraft and, after this incident, you can bet it won't be for some time in the future.

GET A LONGER HANDLE, HILDA!

When the Starlifter's crew lowered the gear handle, there was an unusual shake in the airframe followed by loss of Number 2 hydraulic system. Right main gear indicated "in transit," and visual inspection verified it was about 3 inches from being "down and locked." The scanner attempted to move the downlock pawl into proper position using the main landing gear pry bar, but the pry bar wasn't long enough to provide sufficient leverage. Forced to innovate, the scanner and two student pilots successfully applied a litter stanchion for extra leverage. The gear was pinned and the aircraft safely landed. Because the pry bar was too short to provide sufficient leverage to comply with flight manual emergency procedures, safety investigators cited design deficiency as the cause for a near mishap. Nonetheless, a MAC crew once again proved that necessity is indeed the "Mother of Invention."


WHAT YOU WANT FOR XMAS CAN'T BE BROUGHT BY SANTA . . . YOU HAVE TO "GIVE IT" TO YOURSELF ! ! !
— A promotion . . .
— A new car . . .
— A win in the lottery . . .
— A loss or gain of 10 pounds . . .
— Your name in print . . .
— Your thoughts read by thousands of readers . . .
— An "Attaboy" from the boss . . .
— A beautiful desk set . . .
— An impressive plaque to adorn your wall . . .
Well, we can't grant you the first four wishes but we *can* offer you the opportunity to realize the other five. All you have to do is enter the 1989 MAC Flight Safety Writing Contest ! ! ! See the rules below.

THE RULES

The 1989 MAC Flight Safety Writing Contest is conducted according to MACR 900-3 and these rules. Entries must be original, unpublished, *contain an aviation safety/mishap prevention message*, and be postmarked no later than 31 March 1989. Stories must be between 1,000 and 3,000 words long (approximately 6 to 14 double-spaced typed pages). Poetry should average 75 to 100 lines. Manuscripts must be typed, double-spaced, and submitted in two copies. Identify entries by title only and attach a cover sheet indicating author's name, address, duty phone, unit and home address. Please include a brief autobiography.

The contest is open to all. Entries qualifying under the above rules earn their author a complimentary one-year subscription to *TMF*. However, desk sets and plaques may be awarded only to military members and civilian employees of the Department of the Air Force and Air Reserve Components. Other entries may be selected for Honorable Mention in a special category.

Winning entries will be published in *TMF*. Submit to:

MAC Flight Safety Writing Contest
HQ MAC/IGFE
Scott AFB, Illinois 62225-5101

After Deadlines

***ASSOCIATE EDITORS NEEDED--** We need TWO associate editors, anytime after January 1989. If you are a rated major looking for new challenges and a rewarding job, give us a special look. A background in safety, journalism, or public relations is helpful but not absolute. If interested, contact the Supervising Editor, HQ MACIIGFE, Scott AFB, Illinois, 62225-5101, or call AV 576-3534/5542.*

LOCKHEED DELIVERS FIRST "FUTURE" AC-130U--Lockheed delivered the first of 12 C-130H airplanes under the Gunship Replacement Program for conversion to AC-130U gunships. The AC-130U is the latest version of the AC-130 gunship currently operated by U.S. Special Operations Forces. AC-130U improvements over earlier AC-130 models include an advanced fire control system, integrated avionics, new sensors, upgraded weapons, and the latest electronic warfare equipment. These improvements will enhance the AC-130s' ability to detect, identify, and surgically destroy ground targets using precision firepower. Under the Gunship Replacement Program, AC-130Us will be delivered to Air Force units starting in 1991.

MH-53 PAVE LOW HELICOPTER CRASH--A Military Airlift Command MH-53, with six crewmen on board, crashed 20 October 1988, at Fort Pickett, Va. The helicopter, assigned to the 20 SOS, Hurlburt Field, Fla., was on a training mission. There were no fatalities, although one crewmember was injured.

OOPS....*TMF* LEAVES DESERVING UNIT OUT--While giving well-deserved recognition to units fighting fires in Montana, we failed to recognize efforts put in by C-130s from the 36 TAS, McChord AFB, Wash. The omission was due to lack of information and not intentional.

U.S. Government Printing Office: 1988—654-015/1

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